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AGRICULTURAL MEMORANDUM NO. 395

Heavy rains and field drainage 1. NORTH

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Using the 1951-1960 daily rainfall records from 35 stations in England and Wales, with a range of average annual rainfall from 500 to 1600 mm (20-64 in.), the number of occasions were found of rainfalls of 50 mm or more, 75 mm or more, and 100 mm or more over periods of 1, 2, 3, ... 8 days.

These data were then analysed according to whether the soil was below capacity, and therefore likely to be able to absorb such rainfall, or whether the soil was at or very near to capacity and therefore be liable to temporary waterlogging.

The soil moisture deficit was estimated in the manner described in MAFF Technical Bulletin No. 24.

Eight of the sample stations lay in the north, namely:-

11.	York (627 mm)	15.	Carlisle (815 mm)
12.	Durham (668 mm)	16.	Bradford (853 mm)
13.	Wakefield (670 mm)	17.	Ruthwell (937 mm)
14.	Cockle Park (729 mm)	18.	Settle (1188 mm)

The analysed data are summarized in the following tables:-

Table 1A	Total occasions in 10 years
1B	Occasions in 10 years when soil was below capacity
1C	Occasions in 10 years when soil was at capacity

These values were then smoothed using graphical methods, with the following results for the times when soil was at capacity.

Table 1D	Occasions in 10 years.	50 mm or more.	1-8 days.	600-1200 mm
1E	Occasions in 10 years.	75 mm or more.	1-8 days.	600-1200 mm
1F	Occasions in 10 years.	100 mm or more	1-8 days.	600-1200 mm
1G	Occasions in 10 years in individual categories of days and rainfall			

Any comments or suggestions on this paper should be referred to the author.

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Table 1A Total occasions in 10 years (a) 50–75 mm (b) 75–100 mm (c) over 100 mm

	Site	Annual Average		Period of Days 1	2	3	4	5	6	7	8 days or less
11.	York	627	(a)	0	2	5	13	19	33	50	71
			(b)	0	0	0	0	2	4	9	16
			(c)	0	0	0	0	0	1	2	3
			TOTAL	0	2	5	13	21	38	61	90
12.	Durham	668	(a)	0	2	7	17	29	35	44	65
			(b)	0	0	0	1	3	6	12	19
			(c)	0	0	0	0	0	0	0	0
			TOTAL	0	2	7	18	32	41	56	84
13.	Wakefield (Yorks.)	670	(a)	0	0	5	14	27	42	56	75
			(b)	0	0	0	0	1	2	6	12
			(c)	0	0	0	0	0	0	0	0
			TOTAL	0	0	5	14	28	44	62	87
14.	Cockle Park (Northumberland)	729	(a)	1	4	11	27	51	73	91	110
			(b)	0	0	0	1	4	9	19	30
			(c)	0	0	0	0	0	1	2	4
			TOTAL	1	4	11	28	55	83	112	144
15.	Carlisle (Cumberland)	815	(a)	1	5	9	15	29	50	81	127
			(b)	0	0	1	3	5	7	11	15
			(c)	0	0	0	0	0	1	2	3
			TOTAL	1	5	10	18	34	58	94	145
16.	Bradford (Yorks)	853	(a)	2	6	13	28	64	103	156	210
			(b)	0	0	2	4	5	8	15	32
			(c)	0	0	0	0	1	3	4	5
			TOTAL	2	6	15	32	70	114	175	247
17.	Ruthwell (Dumfries)	937	(a)	0	9	24	47	73	123	189	257
			(b)	0	0	1	2	4	10	19	43
			(c)	0	0	0	1	2	4	6	8
			TOTAL	0	9	25	50	79	137	214	308
18.	Settle (Yorks)	1188	(a)	1	11	37	82	150	234	299	389
			(b)	0	0	1	3	18	39	84	113
			(c)	0	0	0	0	0	2	9	21
			TOTAL	1	11	38	85	168	275	392	523

TABLE 1B Soil below Capacity (a) 50-75 mm (b) 75-100 mm (c) Over 100 mm

Site	Annual Average		Period of Days 1	2	3	4	5	6	7	8 days or less
York	627	(a)	0	1	2	6	8	18	30	44
		(b)	0	0	0	0	1	2	3	4
		(c)	0	0	0	0	0	0	0	0
		TOTAL	0	1	2	6	9	20	33	48
Durham	668	(a)	0	1	4	6	8	9	11	19
		(b)	0	0	0	1	2	3	5	6
		(c)	0	0	0	0	0	0	0	0
		TOTAL	0	1	4	7	10	12	16	25
Wakefield	670	(a)	0	0	4	7	11	15	21	29
		(b)	0	0	0	0	0	0	1	2
		(c)	0	0	0	0	0	0	0	0
		TOTAL	0	0	4	7	11	15	22	31
Cockle Park	729	(a)	1	3	7	17	23	34	42	51
		(b)	0	0	0	1	2	2	4	6
		(c)	0	0	0	0	0	0	0	0
		TOTAL	1	3	7	18	25	36	46	57
Carlisle	815	(a)	1	1	1	2	7	12	19	33
		(b)	0	0	0	0	0	0	0	1
		(c)	0	0	0	0	0	0	0	0
		TOTAL	1	1	1	2	7	12	19	34
Bradford	853	(a)	0	1	5	10	15	22	31	46
		(b)	0	0	0	0	0	0	0	2
		(c)	0	0	0	0	0	0	0	0
		TOTAL	0	1	5	10	15	22	31	48
Ruthwell	937	(a)	0	3	7	12	18	26	35	49
		(b)	0	0	0	0	0	1	4	11
		(c)	0	0	0	0	0	0	0	0
		TOTAL	0	3	7	12	18	27	39	60
Settle	1188	(a)	0	0	7	10	21	28	33	44
		(b)	0	0	0	0	0	0	7	8
		(c)	0	0	0	0	0	0	0	0
		TOTAL	0	0	7	10	21	28	40	52

TABLE 1C Soil at Capacity (a) 50-75 mm (b) 75-100 mm (c) Over 100 mm

Site	Annual Average		Period of days 1	2	3	4	5	6	7	8 days or less
York	627	(a)	0	1	3	7	11	15	20	27
		(b)	0	0	0	0	1	2	6	12
		(c)	0	0	0	0	0	1	2	3
		TOTAL	0	1	3	7	12	18	28	42
Durham	668	(a)	0	1	3	11	21	26	33	46
		(b)	0	0	0	0	1	3	7	13
		(c)	0	0	0	0	0	0	0	0
		TOTAL	0	1	3	11	22	29	40	59
Wakefield	670	(a)	0	0	1	7	16	27	35	46
		(b)	0	0	0	0	1	2	5	10
		(c)	0	0	0	0	0	0	0	0
		TOTAL	0	0	1	7	17	29	40	56
Cockle Park	729	(a)	0	1	4	10	28	39	49	59
		(b)	0	0	0	0	2	7	15	24
		(c)	0	0	0	0	0	1	2	4
		TOTAL	0	1	4	10	30	47	66	87
Carlisle	815	(a)	0	4	8	13	22	38	62	94
		(b)	0	0	1	3	5	7	11	14
		(c)	0	0	0	0	0	1	2	3
		TOTAL	0	4	9	16	27	46	75	111
Bradford	853	(a)	2	5	8	18	49	81	125	164
		(b)	0	0	2	4	5	8	15	30
		(c)	0	0	0	0	1	3	4	5
		TOTAL	2	5	10	22	55	92	144	199
Ruthwell	937	(a)	0	6	17	35	55	97	154	208
		(b)	0	0	1	2	4	9	15	32
		(c)	0	0	0	1	2	4	6	8
		TOTAL	0	6	18	38	61	110	175	248
Settle	1188	(a)	1	11	30	72	129	206	266	345
		(b)	0	0	1	3	18	39	77	105
		(c)	0	0	0	0	0	2	9	21
		TOTAL	1	11	31	75	147	247	352	471

TABLE 1D NORTH 50 mm or more: Occasions in 10 years Soil at Capacity

Annual Average	1	2	3	4	5	6	7	8 days or less
600	0	0	2	5	9	15	23	35
650	0	1	3	8	15	24	35	50
700	0	2	4	11	22	35	51	72
750	0	3	6	15	30	48	71	100
800	0	4	8	20	40	64	95	135
850	1	5	10	26	51	82	120	170
900	1	6	12	32	63	100	150	210
950	1	7	15	38	75	120	177	250
1000	1	8	18	44	88	140	208	295
1050	1	9	21	51	102	162	241	340
1100	2	10	24	58	117	186	277	390
1150	2	12	27	66	132	212	315	440
1200	2	14	31	74	150	240	355	490

TABLE 1E NORTH 75 mm or more Occasions in 10 years Soil at Capacity

Annual Average	1	2	3	4	5	6	7	8 days or less
600	0	0	0	0	1	3	6	11
650	0	0	0	0	1	4	7	14
700	0	0	0	0	2	5	8	17
750	0	0	0	1	3	6	10	20
800	0	0	0	1	4	8	13	24
850	0	0	1	2	5	10	17	32
900	0	0	1	2	6	12	22	40
950	0	0	1	3	7	14	28	50
1000	0	0	1	3	9	17	35	60
1050	0	0	2	4	11	21	42	75
1100	0	0	2	4	13	26	50	90
1150	0	0	3	5	16	32	70	110
1200	0	0	3	6	19	42	90	130

TABLE 1F NORTH 100 mm or more Occasions in 10 years Soil at Capacity

Annual Average	1	2	3	4	5	6	7	8 days or less
600	0	0	0	0	0	0	0	0
650	0	0	0	0	0	0	0	1
700	0	0	0	0	0	0	0	2
750	0	0	0	0	0	0	1	3
800	0	0	0	0	0	0	1	4
850	0	0	0	0	0	1	2	5
900	0	0	0	0	0	1	3	6
950	0	0	0	0	0	2	4	8
1000	0	0	0	0	0	2	5	10
1050	0	0	0	0	1	3	6	12
1100	0	0	0	0	1	4	7	15
1150	0	0	0	0	2	5	9	18
1200	0	0	0	0	2	6	11	22

TABLE 1G NORTH Occasions in 10 years Soil at Capacity (a) 50–75 mm (b) 75–100 mm (c) Over 100 mm

Annual Average		Period 1	2	3	4	5	6	7	8	days but not less
600	(a)	0	0	2	3	3	4	5	7	
	(b)	0	0	0	0	1	2	3	5	
	(c)	0	0	0	0	0	0	0	0	
	TOTAL	0	0	2	3	4	6	8	12	35
650	(a)	0	1	2	5	6	6	8	8	
	(b)	0	0	0	0	1	3	3	6	
	(c)	0	0	0	0	0	0	0	1	
	TOTAL	0	1	2	5	7	9	11	15	50
700	(a)	0	2	2	7	9	10	13	12	
	(b)	0	0	0	0	2	3	3	7	
	(c)	0	0	0	0	0	0	0	2	
	TOTAL	0	2	2	7	11	13	16	21	72
750	(a)	0	2	4	8	13	15	19	19	
	(b)	0	0	0	1	2	3	3	8	
	(c)	0	0	0	0	0	0	1	2	
	TOTAL	0	2	4	9	15	18	23	29	100
800	(a)	0	3	5	11	17	20	26	29	
	(b)	0	0	0	1	3	4	3	9	
	(c)	0	0	0	0	0	0	2	2	
	TOTAL	0	3	5	12	20	24	31	40	135
850	(a)	1	3	5	15	22	26	31	35	
	(b)	0	0	1	1	3	4	6	12	
	(c)	0	0	0	0	0	1	1	3	
	TOTAL	1	3	6	16	25	31	38	50	170
900	(a)	1	4	6	19	27	31	40	42	
	(b)	0	0	1	1	4	5	8	15	
	(c)	0	0	0	0	0	1	2	3	
	TOTAL	1	4	7	20	31	37	50	60	210
950	(a)	1	5	8	21	33	38	43	51	
	(b)	0	0	1	2	4	5	12	18	
	(c)	0	0	0	0	0	2	2	4	
	TOTAL	1	5	9	23	37	45	57	73	250
1000	(a)	1	6	10	24	38	44	50	62	
	(b)	0	0	1	2	6	6	15	20	
	(c)	0	0	0	0	0	2	3	5	
	TOTAL	1	6	11	26	44	52	68	87	295
1050	(a)	1	7	11	28	44	50	58	66	
	(b)	0	0	2	2	6	8	18	27	
	(c)	0	0	0	0	1	2	3	6	
	TOTAL	1	7	13	30	51	60	79	99	340
1100	(a)	2	7	13	32	50	56	62	78	
	(b)	0	0	2	2	8	10	21	32	
	(c)	0	0	0	0	1	3	3	8	
	TOTAL	2	7	15	34	59	69	86	118	390
1150	(a)	2	8	15	36	55	63	66	85	
	(b)	0	0	2	3	9	14	33	31	
	(c)	0	0	0	0	2	3	4	9	
	TOTAL	2	8	17	39	66	80	103	125	440
1200	(a)	2	10	16	40	63	67	67	95	
	(b)	0	0	3	3	11	19	43	29	
	(c)	0	0	0	0	2	4	5	11	
	TOTAL	2	10	19	43	76	90	115	135	490